NCSX

NCSX Status and Budget Requirements

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Office of Fusion Energy Sciences
FY-07 Budget Planning Meeting
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Topics

NCSX

- Construction status and near-term plans.
- Plans for FY06-07.
- Budgets.
- Summary.

NCSX is Under Construction!

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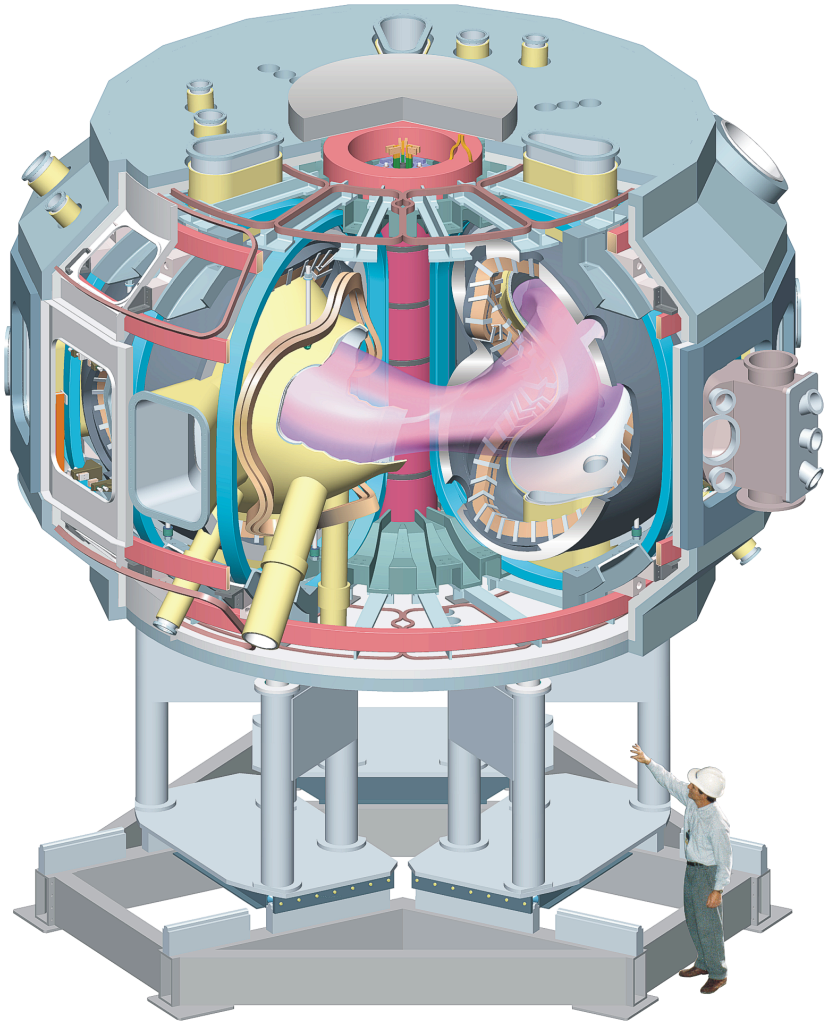
FY04-05:

- CD-3 approved.
- Major contracts placed, fabrication started.
- Components start arriving in June.
- Meeting DOE project management expectations.
  - Semi-annual Lehman reviews.

FY06-07 Plan:

- Continue fabricating components.
- Start building sub-assemblies.



Long-Lead Components Are Being Fabricated

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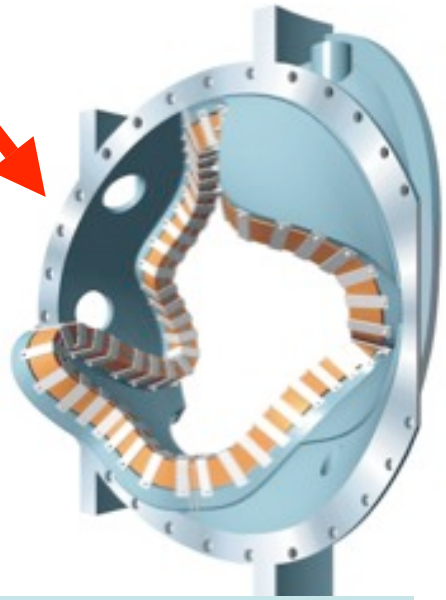
Modular Coil Winding Forms (MCWF)

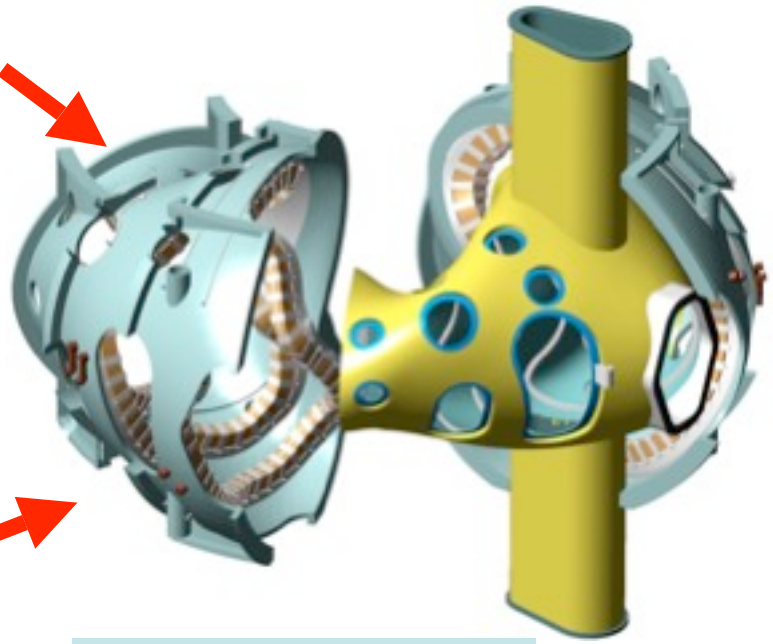
Energy Industries of Ohio, Inc.

Vacuum Vessel

Major Tool & Machine, Inc.



Modular Coils



Field Period Sub-Assembly

Vacuum Vessel Fabrication

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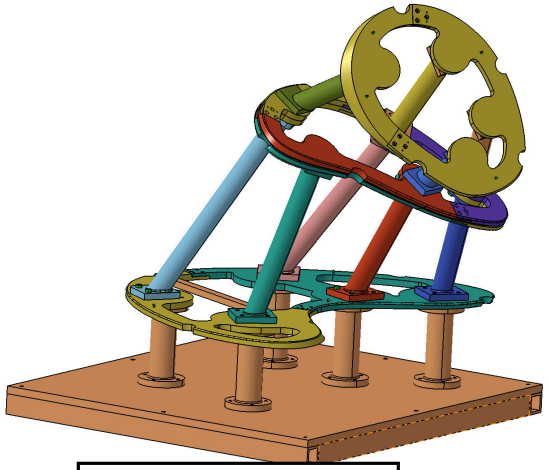
Construction: formed panels welded together.

Progress to date:

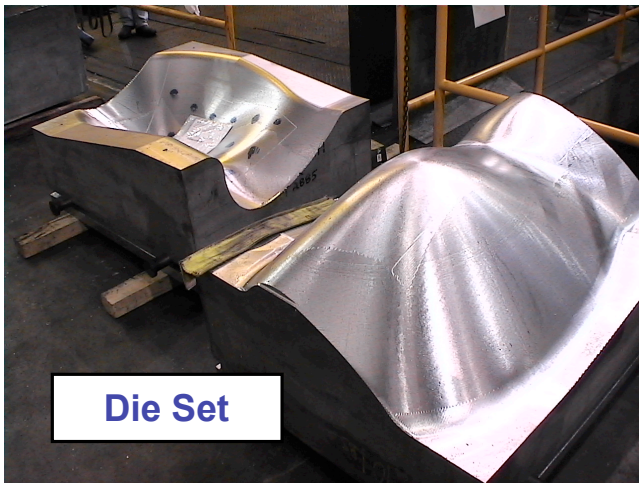
- Segmentation scheme established: maximizes panel size, minimizes welding.
- Material commitments received.
- Dies being fabricated.
- 60° weld fixture designed.

First 120° sector expected Nov., ’05. Last: Feb. ’06.

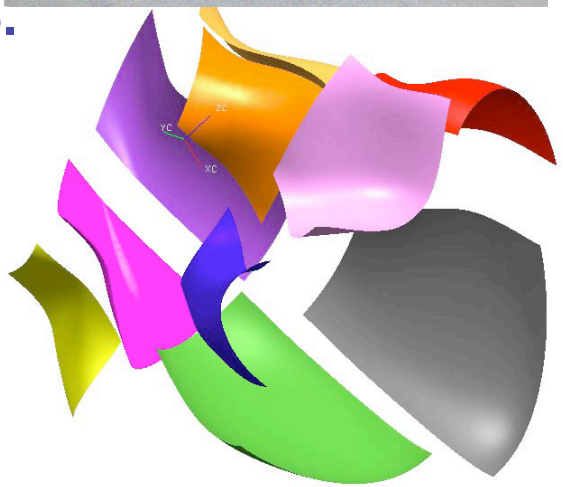
Prototype 20° Sector



Weld Fixture



Die Set



Segmentation Scheme

MCWF Fabrication

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Construction: machined castings.

Progress to date:

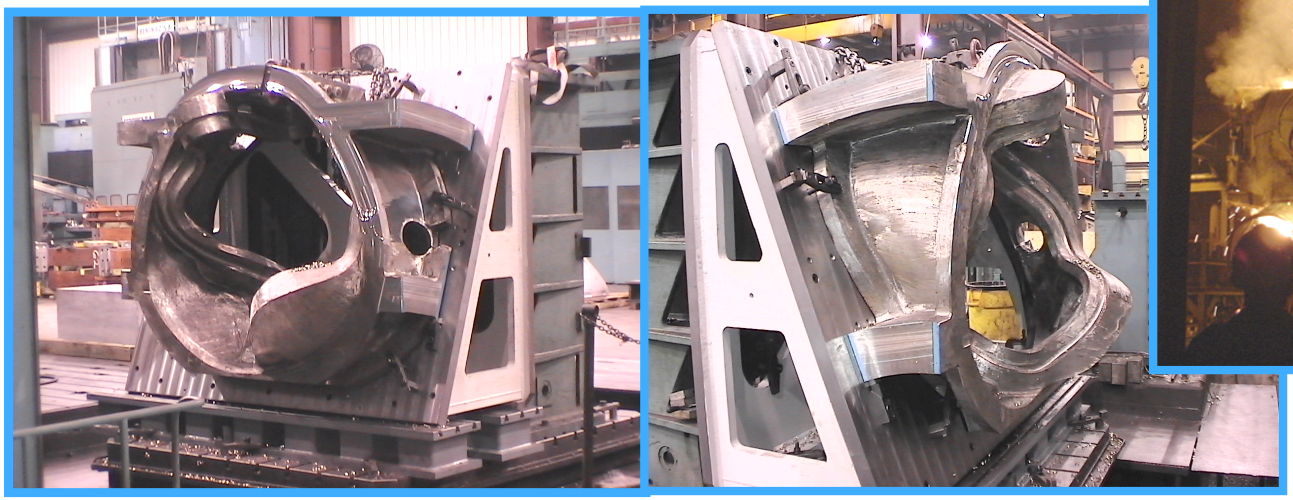
- First casting poured. Currently in-process.
- Pattern design being optimized to reduce processing time on future castings.
- Machining fixtures prepared.

First winding form expected June, ’05.

Last: Sept., ’06.

Pattern Fabrication

Pouring the casting



Machining the Prototype to Test Fixtures

Preparing to Wind the Modular Coils

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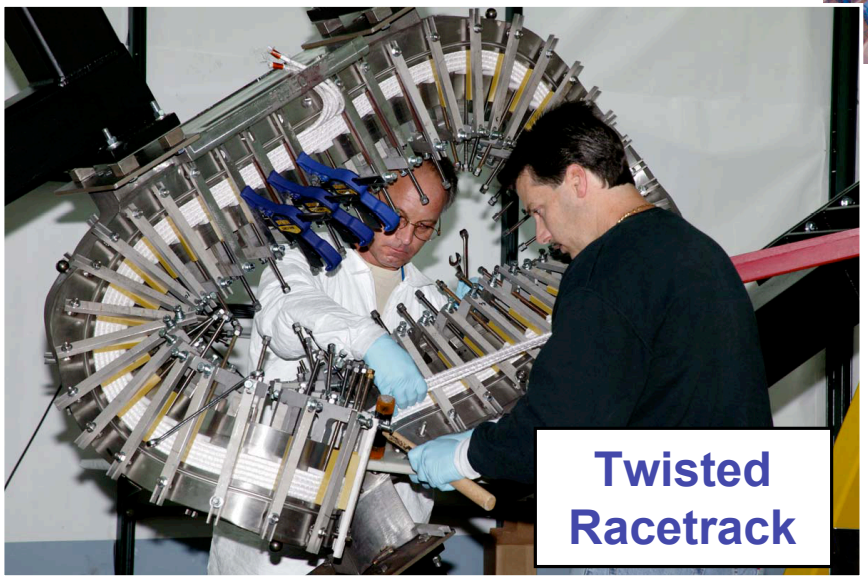
- Manufacturing facility operating.
- Conductor being fabricated.
- **Twisted racetrack demo coil is being wound now.**
  - Optimizing process for accurate and efficient coil winding.
- First production coil will be wound this summer.



New Budget Guidance Stretches Out Construction

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- FY-06 construction funding is reduced by $1.6M from FY-05, and is $6.2M less than approved baseline plan.
- FY-07 guidance: same as FY-06.
- Project is being re-baselined to match new DOE funding plan.
  - No change in machine capabilities or mission.
  - No change in MCWF and VV fabrication contracts.
  - Stretch modular coil winding activity (2 lines single-shift *vs.* 3 lines double-shift).
  - First plasma delayed until 2009, project cost increase several $M.
    - To be accurately quantified via re-baselining,
  - DOE re-baselining review is planned for April 25.

Priority: complete construction as fast as possible within new funding constraints.

Stellarator Core Construction Plans, FY-06 and -07

(Milestone Dates)

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Vacuum Vessel

- Fabricate vessel and ports in FY05-06. **(5/06)**
- Install external magnetic loops, heating/cooling tubes, insulation, supports.

Modular Coils

- Fabricate all 18 winding forms. **(4/07)**
- Wind most (~80%) of the coils.

Conventional Coils

- Start TF coil fabrication this FY. **(9/05)** Complete most by end of FY-07.
- Final design of PF and trim coils in FY06-07. Start PF fabrication in FY-07. **(9/07)**
- Final design of coil support structures in FY-06, fabrication in FY-07.

Field Period Assembly

- Final design of fixtures in FY05-06. Fabrication in FY06-07.
- Start building sub-assemblies in FY-07. **(9/07)**

Base Support Structure & Cryostat

- Final design in FY05-06, fabrication in FY-07.

Ancillary Systems Plans, FY-06 and -07

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Power Systems

- Existing C-site systems to be tested and configured for NCSX.
- DC cabling, control & protection, AC distribution.

Diagnostics

- Ex-vessel magnetic sensors, e-beam mapping equipment.

Central I&C

- Final design in FY-07.

Auxiliary Equipment

- Vacuum pumping, gas injection.

Facility Systems

- Water, cryogenics, air, GN2.

Test Cell Preparations

- Complete preparations for machine assembly in FY-08.

Research Preparations, FY-06 and -07

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Experimental planning for research on NCSX

- Maintain an up-to-date plan, factoring in program developments.
- Provide physics oversight of NCSX construction, facilitate adherence to physics requirements.

Long-lead analyses to prepare for the experimental program

- Plasma control: in-vessel magnetic sensor requirements.
- Magnetic configurations: identify e-beam mapping conditions to elucidate key configuration characteristics. Effects of field perturbations.
- Diagnostics: requirements for initial NBI heating phases.
- Boundary control: requirements for PFC and edge diagnostics.

Plans for FY-08 and beyond

- Formation of national NCSX research team.
- Implementation of long-lead equipment upgrades.

NCSX PAC advises on priorities and physics activities.

NCSX Program Funding per New Guidance

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$M FY:	2005	2006		2007	
		Guidance	Full Use	Guidance	Full Use
NCSX Fabrication					
PPPL	15.700	14.900	20.500	14.921	18.400
ORNL	1.800	1.000	1.600	1.000	1.000
Total	17.500	15.900	22.100	15.921	19.400
NCSX Research Preparations					
PPPL	0.469	0.445	0.960	0.445	4.400
ORNL	0.240	0.215	0.430	0.215	1.900
LLNL	0.065	0.040	0.120	0.040	0.300
Others			0.200		1.000
Total	0.774	0.700	1.710	0.700	7.600
NCSX Program Total					
PPPL	16.169	15.345	21.460	15.366	22.800
ORNL	2.040	1.215	2.030	1.215	2.900
LLNL	0.065	0.040	0.120	0.040	0.300
Others			0.200		1.000
Total	18.274	16.600	23.810	16.621	27.000

"Full Use" case would restore funding profile to CD-3 baseline and would: pass construction peak in FY-06, ramp up research preparations in FY-07, complete construction in FY-08.

Still Deeper Cuts Would Exacerbate Impacts

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Further 10% cut in FY07 and level thereafter:

- Coil fabrication further stretched out.
- Field period assembly start delayed to ’08.
- Further staffing impacts at PPPL and ORNL.
- Additional ~4-month delay in First Plasma and science results.
- Additional ~$1.5M increase in project cost due to inefficiencies and inflation.

Summary

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- NCSX construction is off to a very good start.
- Machine capabilities and program *content* are not impacted by funding stretchout,
  - but science contributions are delayed by more than a year.
- Priority is to complete construction of NCSX as rapidly as possible within new funding constraints.
  - Supported by NCSX PAC.
- New project baseline being developed, per DOE direction.
  - Baseline review in April.